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Relevance scale ☐ ☐ ☐ ☐ ☐**1 [Towards interactive bump mapping with anisotropic shift-variant BRDFs](#)**

Jan Kautz, Hans-Peter Seidel

August 2000 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware**

Full text available: pdf(3.98 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In this paper a technique is presented that combines interactive hardware accelerated bump mapping with shift-variant anisotropic reflectance models. An evolutionary path is shown how some simpler reflectance models can be rendered at interactive rates on current low-end graphics hardware, and how features from future graphics hardware can be exploited for more complex models. We show how our method can be applied to some well known reflectance models, namely the Banks model, War ...

**2 [A user-programmable vertex engine](#)**

Erik Lindholm, Mark J. Kligard, Henry Moreton

August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**

Full text available: pdf(12.03 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In this paper we describe the design, programming interface, and implementation of a very efficient user-programmable vertex engine. The vertex engine of NVIDIA's GeForce3 GPU evolved from a highly tuned fixed-function pipeline requiring considerable knowledge to program. Programs operate only on a stream of independent vertices traversing the pipe. Embedded in the broader fixed function pipeline, our approach preserves parallelism sacrificed by previous approaches. The programmer is presente ...

**Keywords:** graphics hardware, graphics systems**3 [A real-time procedural shading system for programmable graphics hardware](#)**

Kekoa Proudfoot, William R. Mark, Svetoslav Tzvetkov, Pat Hanrahan

August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**

Full text available: pdf(1.20 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Real-time graphics hardware is becoming programmable, but this programmable hardware is complex and difficult to use given current APIs. Higher-level abstractions would both increase programmer productivity and make programs more portable. However, it is challenging to raise the abstraction level while still providing high performance. We have developed a real-time procedural shading language system designed to achieve this goal.


Our system is organized around multiple *computation ...*

**Keywords:** *graphics hardware, graphics systems, rendering, shading languages*

#### 4 Texture shaders

Michael D. McCool, Wolfgang Heidrich

July 1999 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware**

Full text available:  [pdf\(1.36 MB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** BRDFs, OpenGL, hardware acceleration and interactive rendering, illumination, shading languages, shadows

#### 5 Shading and shaders: Shader metaprogramming

Michael D. McCool, Zheng Qin, Tiberiu S. Popa

September 2002 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS conference on Graphics hardware**

Full text available:  [pdf\(630.20 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Modern graphics accelerators have embedded programmable components in the form of vertex and fragment shading units. Current APIs permit specification of the programs for these components using an assembly-language level interface. Compilers for high-level shading languages are available but these read in an external string specification, which can be inconvenient. It is possible, using standard C++, to define a high-level shading language directly in the API. Such a language can be nearly indist ...

#### 6 Computational Approaches to Image Understanding

Michael Brady

January 1982 **ACM Computing Surveys (CSUR)**, Volume 14 Issue 1

Full text available:  [pdf\(10.04 MB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 7 Shading and shaders: Efficient rendering of spatial bi-directional reflectance distribution functions

David K. McAllister, Anselmo Lastra, Wolfgang Heidrich

September 2002 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS conference on Graphics hardware**

Full text available:  [pdf\(2.80 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We propose texture maps that contain at each texel all the parameters of a Lafortune representation BRDF as a compact, but quite general surface appearance representation. We describe a method for rendering such surfaces rapidly on current graphics hardware and demonstrate the method with real, measured surfaces and hand-painted surfaces. We also propose a method of rendering such spatial bi-directional reflectance distribution functions

using prefiltered environment maps. Only one set of maps is ...

**Keywords:** graphics hardware, reflectance & shading models, rendering hardware, texture mapping

8 Triangle scan conversion using 2D homogeneous coordinates

Marc Olano, Trey Greer

August 1997 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware**

Full text available:  pdf(846.69 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** clipping, homogeneous coordinates, rasterization, scan conversion

9 High-quality pre-integrated volume rendering using hardware-accelerated pixel shading

Klaus Engel, Martin Kraus, Thomas Ertl

August 2001 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware**

Full text available:  pdf(1.94 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


We introduce a novel texture-based volume rendering approach that achieves the image quality of the best post-shading approaches with far less slices. It is suitable for new flexible consumer graphics hardware and provides high image quality even for low-resolution volume data and non-linear transfer functions with high frequencies, without the performance overhead caused by rendering additional interpolated slices. This is especially useful for volumetric effects in computer games and profes ...

**Keywords:** PC graphics hardware, direct volume rendering, flexible graphics hardware, multi-textures, rasterization, volume graphics, volume shading, volume visualization

10 Rendering: Rendering higher order finite element surfaces in hardware

Rahul Khardekar, David Thompson

February 2003 **Proceedings of the 1st international conference on Computer graphics and interactive techniques in Australasia and South East Asia**

Full text available:  pdf(7.52 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Graphics hardware is becoming flexible enough to move more than just the traditional rendering pipeline off the CPU and onto the graphics card. We demonstrate a technique for rendering nonlinear (quadratic in our case) finite element boundaries, deflected by a vector field value and colored by a scalar field value. Simple performance measurements indicate that moving field value interpolation to the graphics card results yields roughly 50% speedup, however current hardware limits the color preci ...

**Keywords:** higher order element, pixel shaders, rendering, view-dependent

11 Shading and shadows: Fast, arbitrary BRDF shading for low-frequency lighting using spherical harmonics

Jan Kautz, Peter-Pike Sloan, John Snyder

July 2002 **Proceedings of the 13th Eurographics workshop on Rendering**


Full text available:  pdf(3.93 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index](#)

terms

Real-time shading using general (e.g., anisotropic) BRDFs has so far been limited to a few point or directional light sources. We extend such shading to smooth, area lighting using a low-order spherical harmonic basis for the lighting environment. We represent the 4D product function of BRDF times the cosine factor (dot product of the incident lighting and surface normal vectors) as a 2D table of spherical harmonic coefficients. Each table entry represents, for a single view direction, the integ ...

**12 Unstructured grids: Hardware-based view-independent cell projection**

Manfred Weiler, Martin Kraus, Thomas Ertl

October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**Full text available:  [pdf\(1.16 MB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present the first, view-independent cell projection algorithm for off-the-shelf programmable graphics hardware. Our implementation performs all computations for the projection and scan conversion of a set of tetrahedra on the graphics hardware and is therefore compatible with many of the hardware-accelerated optimizations for polygonal graphics, e.g. OpenGL vertex arrays and display lists. Apart from our actual implementation, we discuss potential improvements on future, more flexible graphic ...

**Keywords:** cell projection, pixel shading, programmable graphics hardware, ray tracing, tetrahedral meshes, unstructured meshes, volume rendering, volume visualization

**13 Stylized rendering techniques for scalable real-time 3D animation**

Adam Lake, Carl Marshall, Mark Harris, Marc Blackstein

June 2000 **Proceedings of the 1st international symposium on Non-photorealistic animation and rendering**Full text available:  [pdf\(2.25 MB\)](#)Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** cartoon effects, cartoon rendering, pencil sketch rendering, real-time nonphotorealistic animation and rendering, silhouette edge detection, stylized rendering

**14 Compiling to a VLIW fragment pipeline**

William R. Mark, Kekoa Proudfoot

August 2001 **Proceedings of the ACM SIGGRAPH/EUROGRAPHICS workshop on Graphics hardware**Full text available:  [pdf\(144.85 KB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The latest generation of graphics hardware supports fully programmable vertex and pixel/fragment operations, but programming this hardware at a low level is difficult and time consuming. To address this problem, we have developed a complete real-time procedural shading system that compiles a high-level shading language to programmable vertex and fragment hardware, as described in a separate publication. In this paper, we describe in detail the algorithms used by this system to generate and op ...

**15 Status report of the graphic standards planning committee**

Computer Graphics staff

August 1979 **ACM SIGGRAPH Computer Graphics**, Volume 13 Issue 3Full text available:  [pdf\(15.01 MB\)](#)Additional Information: [full citation](#), [references](#), [citations](#)

### 16 Making faces

Brian Guenter, Cindy Grimm, Daniel Wood, Henrique Malvar, Fredric Pighin

July 1998 **Proceedings of the 25th annual conference on Computer graphics and interactive techniques**

Full text available:  pdf(1.70 MB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

### 17 Real-time procedural textures

John Rhoades, Greg Turk, Andrew Bell, Andrei State, Ulrich Neumann, Amitabh Varshney

June 1992 **Proceedings of the 1992 symposium on Interactive 3D graphics**

Full text available:  pdf(822.02 KB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

### 18 Session II: Programming graphics processors functionally

Conal Elliott

September 2004 **Proceedings of the ACM SIGPLAN workshop on Haskell**

Full text available:  pdf(673.50 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Graphics cards for personal computers have recently undergone a radical transformation from fixed-function graphics pipelines to multi-processor, programmable architectures. Multi-processor architectures are clearly advantageous for graphics for the simple reason that graphics computations are naturally concurrent, mapping well to stateless stream processing. They therefore parallelize easily and need no random access to memory with its problematic latencies. This paper presents *Vertigo*, a ...

**Keywords:** 3D modeling, code generation, compilers, computer algebra, computer graphics, domain-specific languages, functional geometry, functional programming, graphics languages, graphics processors, partial evaluation, procedural geometry, procedural shading, shading languages

### 19 Color gamut mapping and the printing of digital color images

Maureen C. Stone, William B. Cowan, John C. Beatty

October 1988 **ACM Transactions on Graphics (TOG)**, Volume 7 Issue 4

Full text available:  pdf(6.06 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Principles and techniques useful for calibrated color reproduction are defined. These results are derived from a project to take digital images designed on a variety of different color monitors and accurately reproduce them in a journal using digital offset printing. Most of the images printed were reproduced without access to the image as viewed in its original form; the color specification was derived entirely from calorimetric specification. The techniques described here are not specific ...

### 20 Lighting & sampling: Triple product wavelet integrals for all-frequency relighting

Ren Ng, Ravi Ramamoorthi, Pat Hanrahan

August 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 3

Full text available:  pdf(365.55 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper focuses on efficient rendering based on pre-computed light transport, with realistic materials and shadows under all-frequency direct lighting such an environment

maps. The basic difficulty is representation and computation in the 6D space of light direction, view direction, and surface position. While image-based and synthetic methods for real-time rendering have been proposed, they do not scale to high sampling rates with variation of both lighting and viewpoint. Current approaches ...

**Keywords:** Haar Wavelets, Image-Based Rendering, Non-linear Approximation, Pre-computed Radiance Transfer, Relighting

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